REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested. Claims 1-26 are now pending, wherein claims 1, 12, 14, 18 and 20-25 have been amended, and claim 26 has been added. Support for new claim 26 can be found in the present application at least in figure 5, and in paragraphs 0039-0052 and 0064-0068.

Initially, Applicant notes with appreciation the indication in the ninth paragraph of the Office Action that claims 5, 6 and 8-10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Attached herewith is a Request For Approval of Drawing Changes proposing changes to Figure 5. Specifically, it is proposed to place a negative sign in front of the term C_4 in two places in Figure 5. Support for this proposed change can be found in the present application at least at paragraph 0068.

In the first paragraph of the Office Action the disclosure is objected to because claim 1 and a portion of claim 2 is contained on the last page of the Detailed Description section of the application. The specification has been amended to delete this matter from this portion of the application. Accordingly, withdrawal of this objection is respectfully requested.

In the second and third paragraphs of the Office Action it is asserted that the application is improperly incorporating by reference essential material. Specifically, the Office Action notes that the application incorporates by reference several publications. The Office Action suggests amending the application to include the disclosure of the material incorporated by reference. However, such a procedure is only required when essential material is incorporated by reference. It is respectfully submitted that the publications incorporated by reference into the present application are not essential material with respect to the application as filed; and hence, amendment of the specification in the manner suggested in the Office Action is not required.

In the fourth paragraph of the Office Action it is noted that the application was filed without a claim 19, and that originally filed claims 20-26 have been renumbered as claims 19-25. This paragraph also states that the dependancy of these claims should be

amended. Accordingly, the dependancy of claims 20, 22, 24 and 25 have been amended in accordance with the new numbering of originally filed claims 20-26.[1]

In the fifth and sixth paragraphs of the Office Action claim 20 is rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Claim 20 has been amended to address the concerns raised in the Office Action. Accordingly, withdrawal of this rejection is respectfully requested.

In the seventh and eighth paragraphs of the Office Action claims 1-4, 7, 11-13 and 14-25 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 6,006,145 to Bessacini ("Bessacini"). This ground of rejection is respectfully traversed.

Prior to addressing this ground of rejection in detail, a brief summary of the present invention is provided to highlight advantageous characteristics thereof.

The present invention relates to guidance and control systems, and more particulary, to adaptive guidance and control systems. Although conventional guidance and control systems are known, these systems suffer from many deficiencies. For example, as discussed in the Background section of the present application, many of these conventional systems are subject to the zero or constant maneuver frequency assumptions, thereby wasting valuable energy against highly maneuverable targets. The present invention overcomes this deficiency of prior guidance and control systems by estimating the target maneuver frequency. Specifically, the present invention adapts the control signals to the on-board guidance control of a device based upon the time-varying maneuvering of a target, thereby conserving valuable energy against highly maneuverable targets.

Bessacini does not anticipate claim 1 because Bessacini does not disclose all of the elements of Applicant's claim 1. For example, Bessacini does not disclose that "the means for generating adapts the guidance command signal based on an estimate of target maneuver frequency" as recited in Applicant's claim 1.

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[1]Hereinafter all claims will be referred to by the new numbering provided by the docket clerk.

Bessacini discloses a method and apparatus for directing a pursuing vehicle to a target with intelligent evasion capabilities. Specifically, a launching vehicle employs a guidance system to control the pursuing vehicle. As illustrated in figure 2 of Bessacini, the guidance system employs models of the evading target to provide proposed trajectories based upon various environmental conditions. Bessacini concludes, at column 8, lines 3-8, that "more accurate estimations of a target vehicle evasive maneuver are possible because the selection is based upon expected conditions at the time of alertment." Since Bessacini bases selection upon expected conditions, Bessacini does not disclose "the means for generating adapts the guidance command signal based on an estimate of target maneuver frequency" as recited in Applicant's claim 1. Furthermore, Bessacini, at column 5, lines 7-9, states that "[a]fter the target vehicle 10 completes an evasive maneuver, it is assumed that the target vehicle continues along a straight line, S_{ca}, to an intercept time, t_i." Accordingly, the system of Bessacini would not "adapt the guidance command signal based on an estimate of target maneuver frequency" because it assumes that the target continues along a straight line following completion of an evasive maneuver, and hence, Bessacini does not account for target maneuver frequency.

Claims 2-13 and 26 variously depend from claim 1, and are, therefore, patentably distinguishable over Bessacini for at least those reasons stated above with regard to Applicant's claim 1.

Claims 14, 21 and 23 recite similar subject matter to that discussed above with regard to Applicant's claim 1, and are, therefore, patentably distinguishable over Bessacini for similar reasons to those discussed above with regard to Applicant's claim 1. Claims 15-20, 22, 24 and 25 variously depend from claims 14, 21 and 23, and are, therefore, patentably distinguishable over Bessacini for at least those reasons stated above with regard to claims 14, 21 and 23.

For at least those reasons stated above, it is respectfully requested that the rejection of claims 1-4, 7, 11-13 and 14-25 as allegedly being anticipated by Bessacini be withdrawn.

All outstanding objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance. Notice to this effect is earnestly solicited. If there are any questions regarding this response, or the application in general, the Examiner is encouraged to contact the undersigned at 703-838-6578.

Respectfully submitted,

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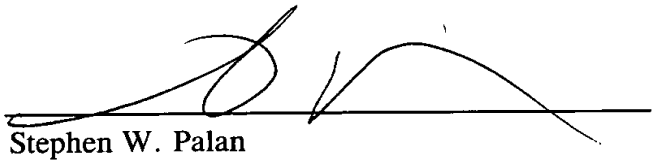
By: 

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Date: October 3, 2002

Attachment To Amendment Dated October 3, 2002

Marked Up Claims 1, 12, 14, 18 and 20-25

1. (Amended) A system for guiding a device toward an object comprising:

means for generating a guidance command signal from: a vectored line-of-sight (LOS) between a device and an object using a position parameter of the object relative to a guidance frame, and an estimated object state produced in the guidance frame using the vectored line-of-sight, wherein the means for generating adapts the guidance command signal based on an estimate of target maneuver frequency; and

means for transmitting the guidance command signal to an on-board guidance control of the device.

12. (Amended) A system for guiding a device toward an object in accordance with claim 1, wherein the means for generating a guidance command signal comprises: [;]

an augmented proportional navigational controller.

14. (Amended) A method for guiding a device toward an object comprising the steps of:

creating a vectored object line-of-sight (LOS)in a guidance frame;

producing an estimated object state, using sequential object LOS;

using proportional navigation control to create a device guidance command as a function of an estimated range vector and an estimated velocity vector obtained using the estimated object state, wherein the device guidance command is adapted based on an estimate of target maneuver frequency.

18. (Amended) A method for guiding a device toward an object according to claim 16, wherein the step of creating an periodically adaptive guidance command comprises the step of: [;]

using a function of object maneuver frequencies, time-to-go before intercept, maneuver frequency correlation time constants, estimated target accelerations and estimated object acceleration rates.

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20. (Amended) A method for guiding a device toward an object in accordance with claim 19 [20], wherein the step of producing an estimated object state comprises the step of:

processing plural sequential estimated range vectors into an object state estimator in an inertial guidance frame estimated object state, wherein the estimated object state [can include] includes range, velocity, object acceleration and object acceleration rate.

21. (Amended) A guidance system for guiding a device toward an object comprising:

means for generating a signal representing a predicted position of the object from: object position parameters relative to a guidance frame and a periodically adaptive estimated object state produced in the guidance frame using the object position parameters; wherein the means for generating adapts the signal based on an estimate of target maneuver frequency; and,

means for transmitting the signal to an on-board guidance control of the device.

22. (Amended) A guidance system for guiding a device toward an object according to claim 21 [22], comprising: [;]

a fire control platform

wherein the means for generating a signal representing the predicted position of the object is located on the fire control platform, and the fire control platform is remote from the device.

23. (Amended) A method for guiding a device toward an object comprising the steps of:

obtaining object position parameters;

periodically adaptively producing an estimated object state;

creating a predicted position from the estimated object state; and,

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determining a guidance command from the predicted position of the object, wherein the guidance command is adapted based on an estimate of target maneuver frequency.

24. (Amended) A method for guiding a device toward an object according to claim 23 [24] comprising the steps of:

transmitting the predicted position of the object from a remote location to the device;

wherein the step of determining a guidance command is performed on the device.

25. (Amended) A method for guiding a device toward an object according to claim 23 [24], comprising the steps of: [;]

obtaining device position parameters;

determining at a remote location a time-to-intercept; and,

transmitting the time-to-intercept from the remote location to the device.